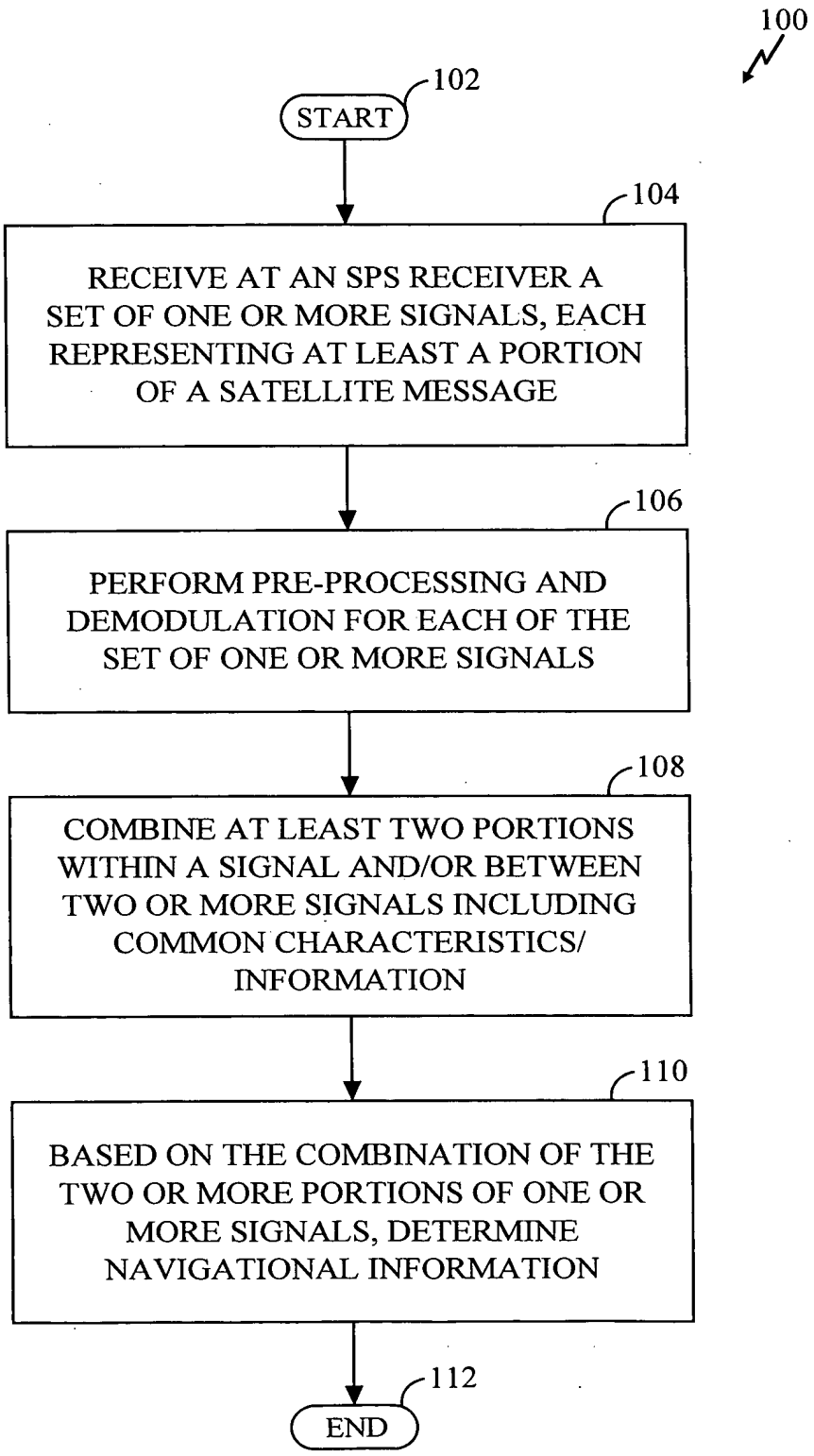
100
102
START
104
RECEIVE AT AN SPS RECEIVER A SET OF ONE OR MORE SIGNALS, EACH REPRESENTING AT LEAST A PORTION OF A SATELLITE MESSAGE
106
PERFORM PRE-PROCESSING AND DEMODULATION FOR EACH OF THE SET OF ONE OR MORE SIGNALS
108
COMBINE AT LEAST TWO PORTIONS WITHIN A SIGNAL AND/OR BETWEEN TWO OR MORE SIGNALS INCLUDING COMMON CHARACTERISTICS/ INFORMATION
110
BASED ON THE COMBINATION OF THE TWO OR MORE PORTIONS OF ONE OR MORE SIGNALS, DETERMINE NAVIGATIONAL INFORMATION
112
END

FIG. 1

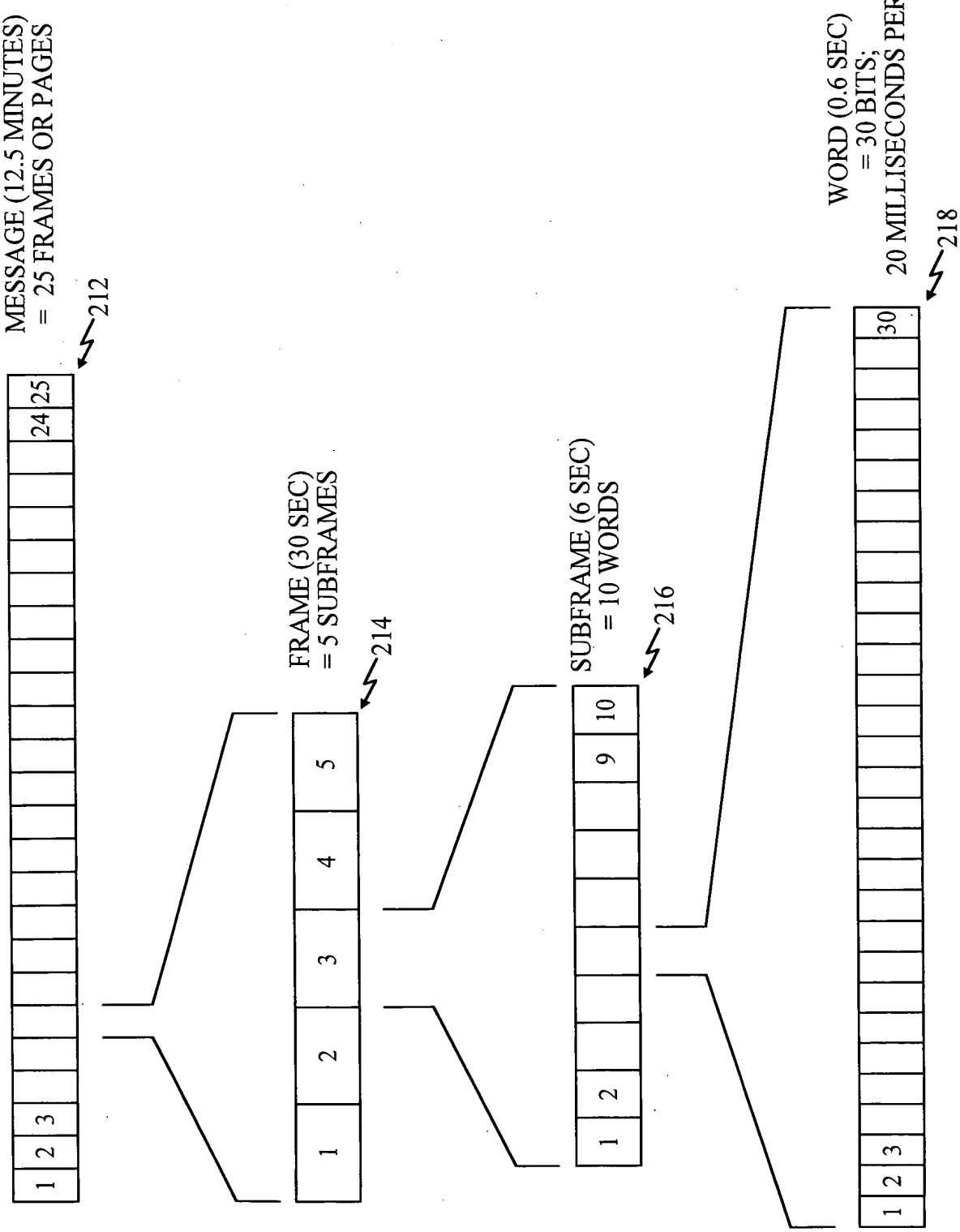
MESSAGE (12.5 MINUTES)
= 25 FRAMES OR PAGES
212
1
2
3
24
25
FRAME (30 SEC)
= 5 SUBFRAMES
214
1
2
3
4
5
SUBFRAME (6 SEC)
= 10 WORDS
216
1
2
9
10
WORD (0.6 SEC)
= 30 BITS;
20 MILLISECONDS PER BIT
218
1
2
3
30

FIG. 2A

$D_1 = d_1 \oplus D_{30}^*$
$D_2 = d_2 \oplus D_{30}^*$
$D_3 = d_3 \oplus D_{30}^*$

•
•
•

$D_{24} = d_{24} \oplus D_{30}^*$
$D_{25} = D_{29} \oplus d_1 \oplus d_2 \oplus d_3 \oplus d_6 \oplus d_8 \oplus d_{10} \oplus d_{11} \oplus d_{12} \oplus d_{13} \oplus d_{14} \oplus d_{17} \oplus d_{18} \oplus d_{20} \oplus d_{23}$
$D_{26} = D_{30} \oplus d_2 \oplus d_3 \oplus d_4 \oplus d_6 \oplus d_7 \oplus d_{11} \oplus d_{12} \oplus d_{13} \oplus d_{14} \oplus d_{15} \oplus d_{18} \oplus d_{19} \oplus d_{21} \oplus d_{24}$
$D_{27} = D_{29} \oplus d_1 \oplus d_3 \oplus d_4 \oplus d_6 \oplus d_7 \oplus d_8 \oplus d_{12} \oplus d_{13} \oplus d_{14} \oplus d_{15} \oplus d_{16} \oplus d_{19} \oplus d_{20} \oplus d_{22}$
$D_{28} = D_{30} \oplus d_2 \oplus d_4 \oplus d_5 \oplus d_6 \oplus d_8 \oplus d_9 \oplus d_{13} \oplus d_{14} \oplus d_{15} \oplus d_{16} \oplus d_{17} \oplus d_{20} \oplus d_{21} \oplus d_{23}$
$D_{29} = D_{30} \oplus d_1 \oplus d_3 \oplus d_5 \oplus d_6 \oplus d_7 \oplus d_9 \oplus d_{10} \oplus d_{14} \oplus d_{15} \oplus d_{16} \oplus d_{17} \oplus d_{18} \oplus d_{21} \oplus d_{22} \oplus d_{24}$
$D_{30} = D_{29} \oplus d_3 \oplus d_5 \oplus d_6 \oplus d_8 \oplus d_9 \oplus d_{10} \oplus d_{11} \oplus d_{13} \oplus d_{15} \oplus d_{19} \oplus d_{22} \oplus d_{23} \oplus d_{24}$

WHERE;

$d_1, d_2, \ldots$ ARE THE SOURCE DATA BITS

THE SYMBOL * IS USED TO IDENTIFY THE LAST 2 BITS OF THE PREVIOUS WORD OF THE SUBFRAME

$D_{25}, \ldots D_{30}$ ARE THE COMPUTED PARITY BITS

$D_1, D_2, \ldots D_{30}$ ARE THE BITS TRANSMITTED BY THE SATELLITE

$\oplus$ IS THE MODULO-2 OR EXCLUSIVE-OR OPERATION

FIG. 2B

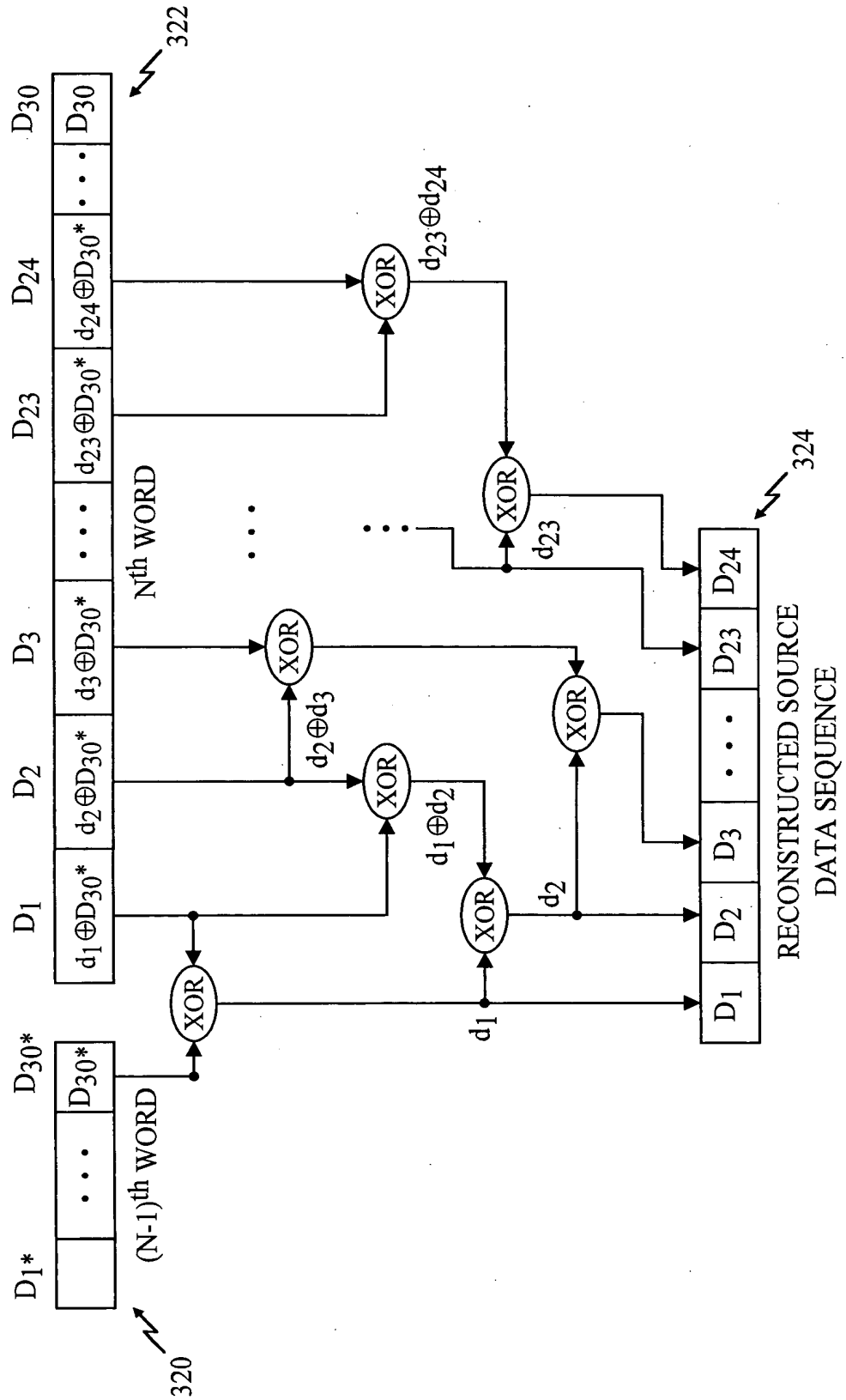
320
322
324
(N-1)th WORD
Nth WORD
RECONSTRUCTED SOURCE
DATA SEQUENCE
XOR
D1*
D30*
D1
D2
D3
D23
D24
D30
d1⊕D30*
d2⊕D30*
d3⊕D30*
d23⊕D30*
d24⊕D30*
d1
d1⊕d2
d2⊕d3
d23
d23⊕d24

FIG. 3

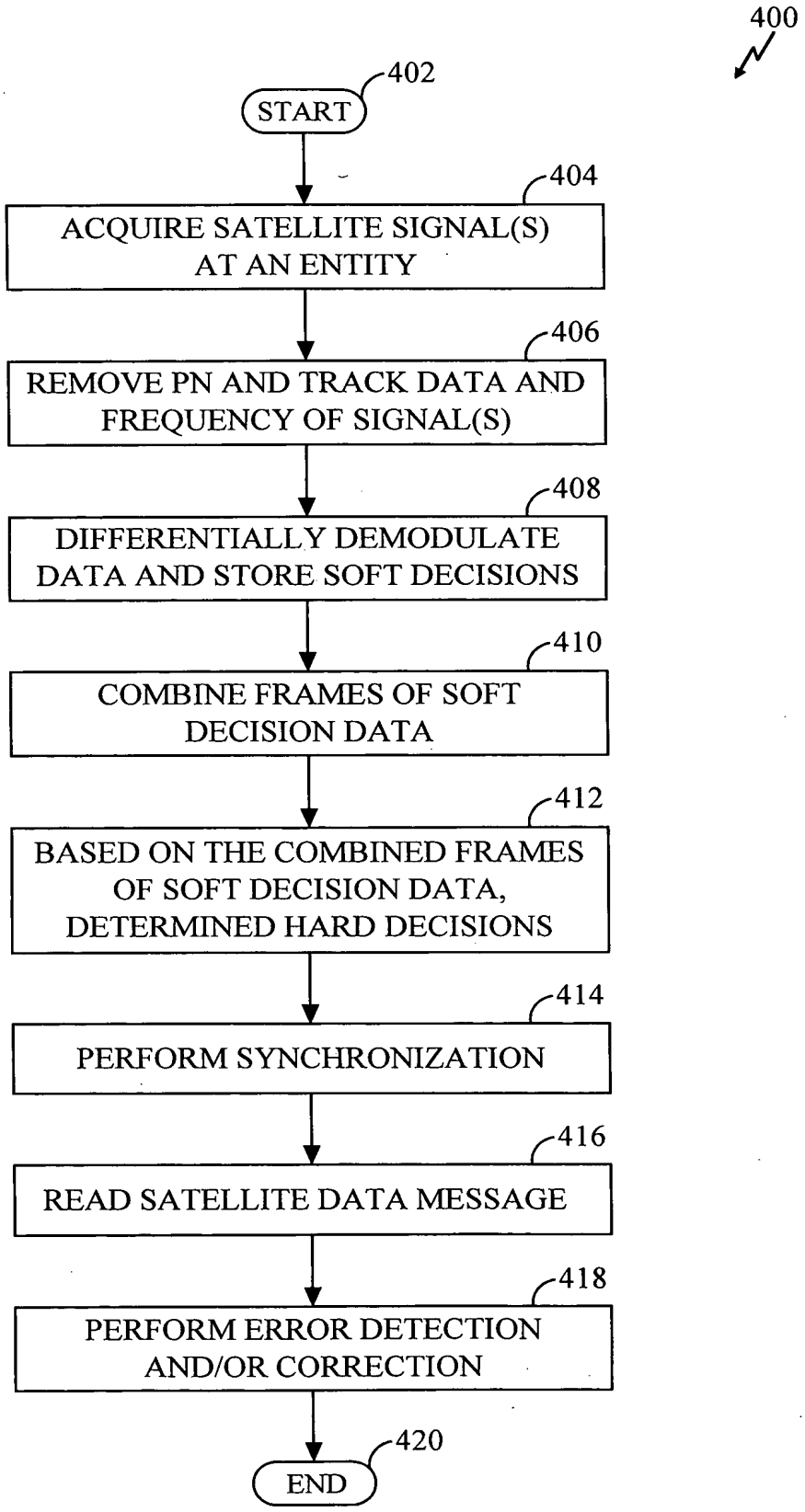
400
402
START
404
ACQUIRE SATELLITE SIGNAL(S) AT AN ENTITY
406
REMOVE PN AND TRACK DATA AND FREQUENCY OF SIGNAL(S)
408
DIFFERENTIALLY DEMODULATE DATA AND STORE SOFT DECISIONS
410
COMBINE FRAMES OF SOFT DECISION DATA
412
BASED ON THE COMBINED FRAMES OF SOFT DECISION DATA, DETERMINED HARD DECISIONS
414
PERFORM SYNCHRONIZATION
416
READ SATELLITE DATA MESSAGE
418
PERFORM ERROR DETECTION AND/OR CORRECTION
420
END

FIG. 4

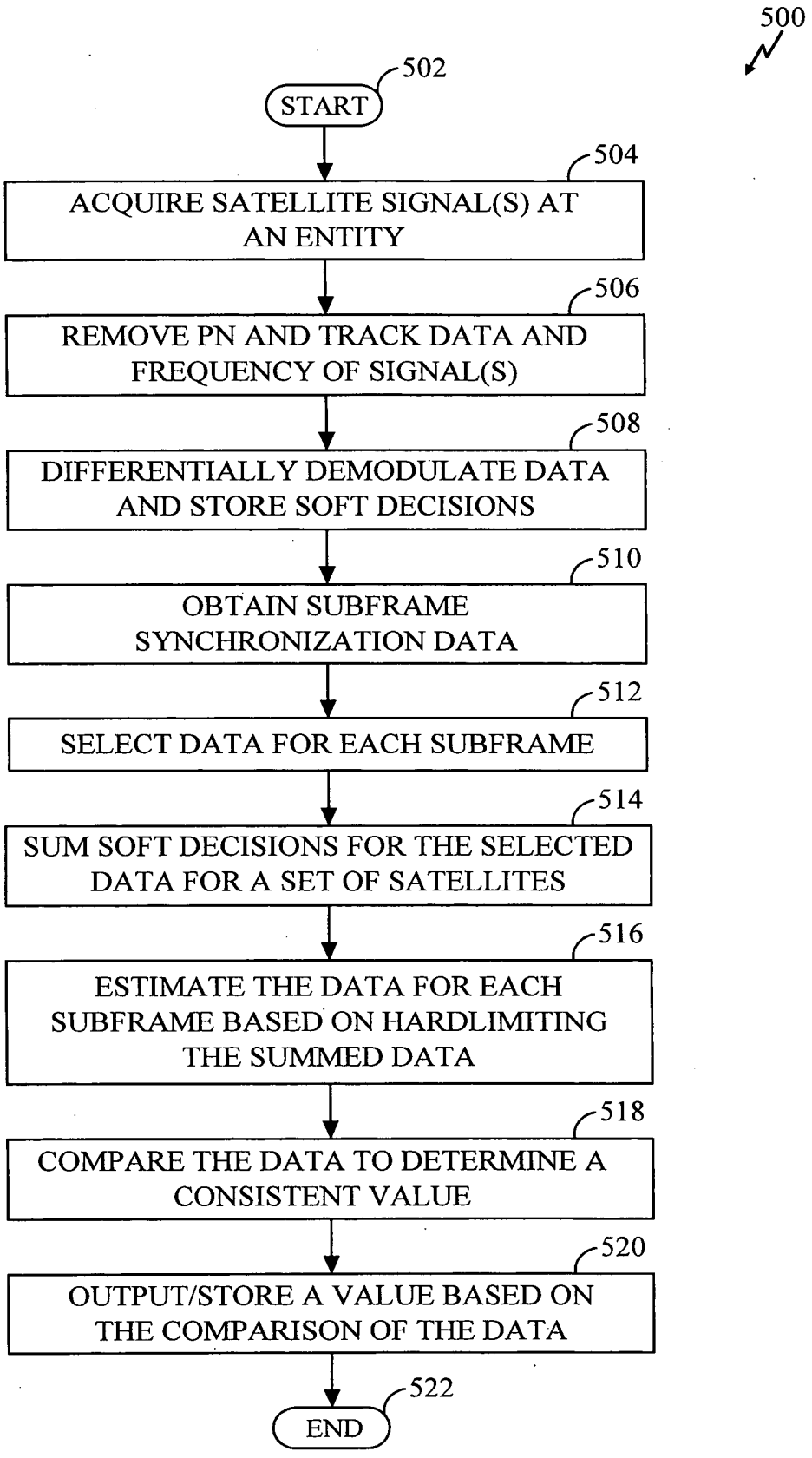
500
502
START
504
ACQUIRE SATELLITE SIGNAL(S) AT AN ENTITY
506
REMOVE PN AND TRACK DATA AND FREQUENCY OF SIGNAL(S)
508
DIFFERENTIALLY DEMODULATE DATA AND STORE SOFT DECISIONS
510
OBTAIN SUBFRAME SYNCHRONIZATION DATA
512
SELECT DATA FOR EACH SUBFRAME
514
SUM SOFT DECISIONS FOR THE SELECTED DATA FOR A SET OF SATELLITES
516
ESTIMATE THE DATA FOR EACH SUBFRAME BASED ON HARDLIMITING THE SUMMED DATA
518
COMPARE THE DATA TO DETERMINE A CONSISTENT VALUE
520
OUTPUT/STORE A VALUE BASED ON THE COMPARISON OF THE DATA
522
END

FIG. 5

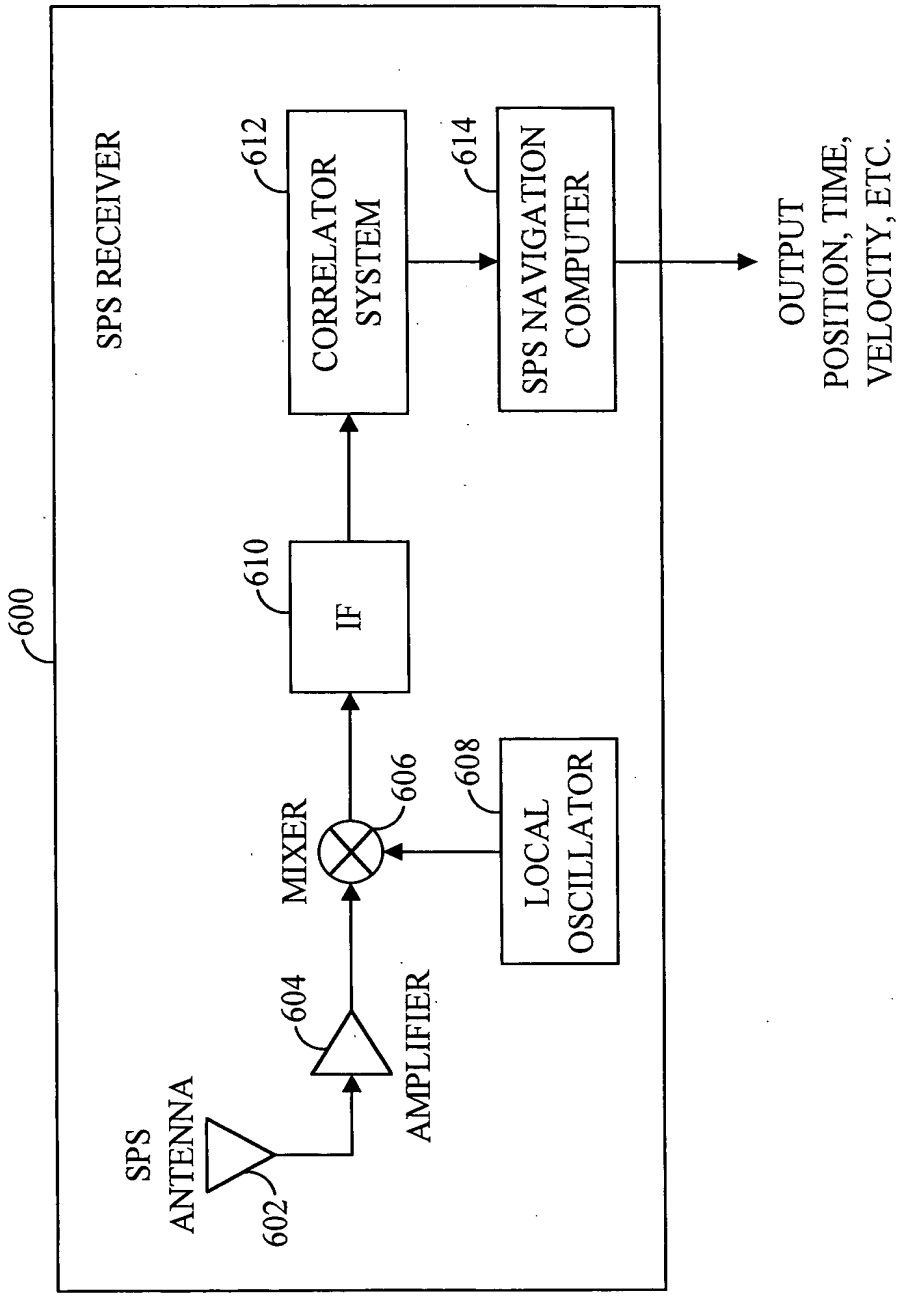
600
SPS RECEIVER
612
CORRELATOR SYSTEM
614
SPS NAVIGATION COMPUTER
OUTPUT
POSITION, TIME,
VELOCITY, ETC.
610
IF
606
MIXER
608
LOCAL OSCILLATOR
604
AMPLIFIER
SPS ANTENNA
602

FIG. 6

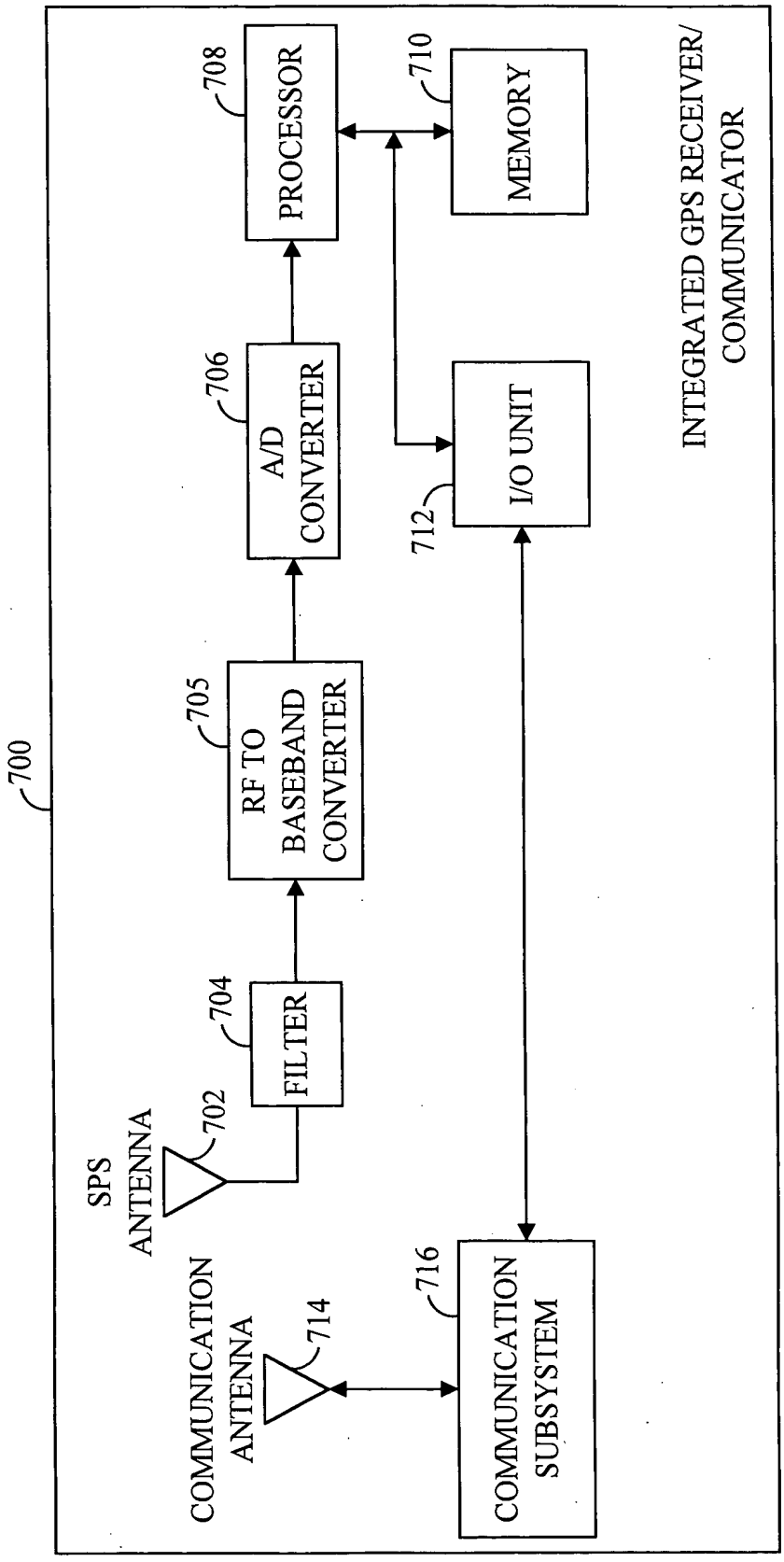
700
INTEGRATED GPS RECEIVER/
COMMUNICATOR
708
PROCESSOR
710
MEMORY
706
A/D
CONVERTER
712
I/O UNIT
705
RF TO
BASEBAND
CONVERTER
704
FILTER
702
SPS
ANTENNA
714
COMMUNICATION
ANTENNA
716
COMMUNICATION
SUBSYSTEM

FIG. 7

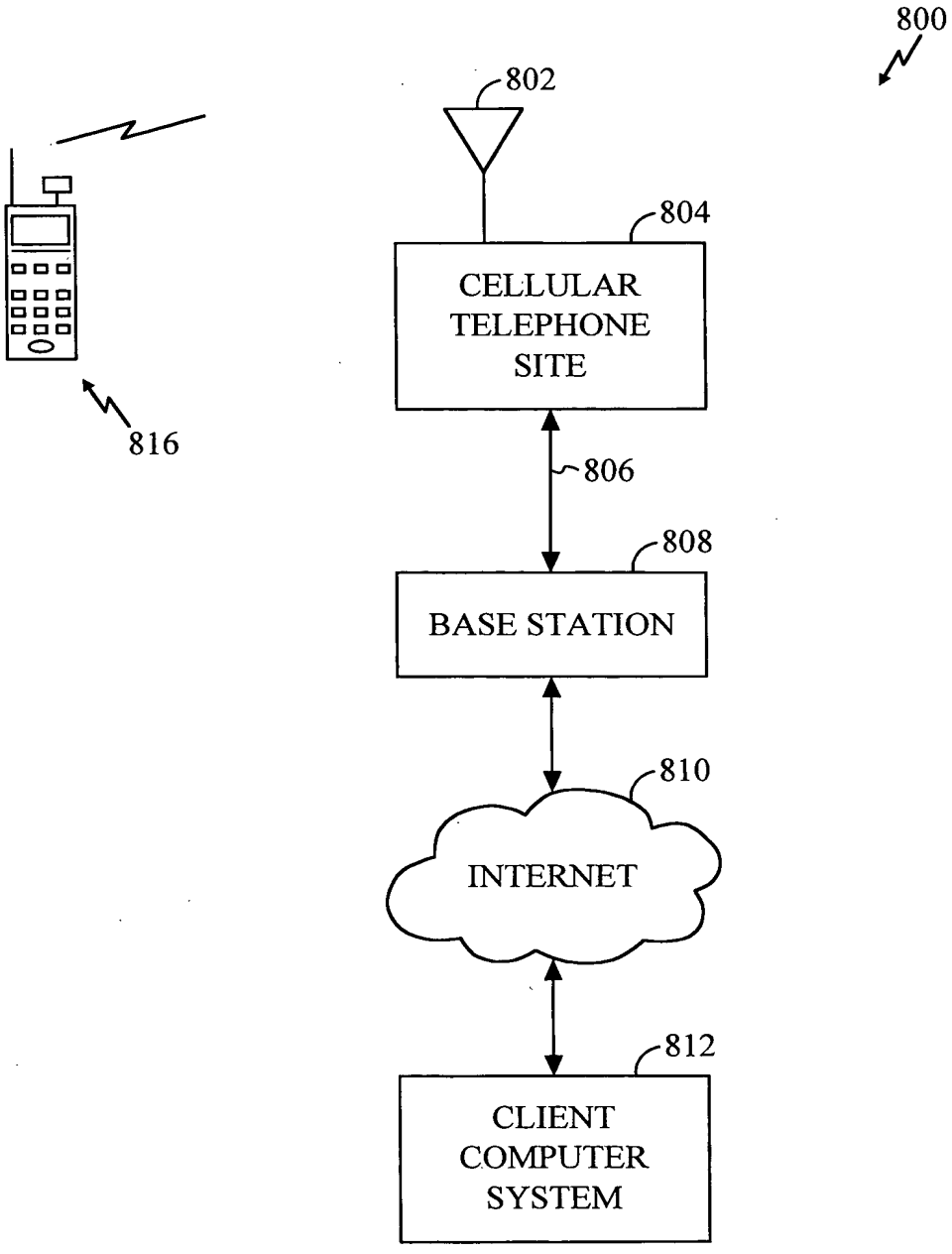
800
802
804
CELLULAR TELEPHONE SITE
806
808
BASE STATION
810
INTERNET
812
CLIENT COMPUTER SYSTEM
816

FIG. 8